Frame 7FA Parts
Improved Design - Extending the Service Life of Your Parts

PW Power Systems (PWPS) designs the combustion liner, flow sleeve, transition piece, and liner cap assembly for the combustion system of the Frame 7FA.03 gas turbine.

**PWPS 7FA.03 Parts Advantages**

The designs incorporate the Pratt & Whitney® extensive high-temperature experience to provide improved total life-cycle costs. The improved designs minimize oxidation, creep and metal temperatures, ultimately extending part life and reducing operating costs through decreased repair work scopes.

PWPS has reviewed engine run distress modes and through use of thermal imaging, stress analysis, and component modeling has engineered solutions to reduce or eliminate these known distress modes. PWPS designs are not replicas of OEM products, but improved versions based on extensive repair history of these OEM products.

**Quality Advantages:**

- Design criteria and quality control are derived from standards applied to aerospace engine development
- Quality systems and certifications are verified against requirements – ISO 9001
- Quality of product is validated throughout design development and production manufacturing to ensure quality is within PWPS standards and that processes are robust and repeatable. This is completed through on-site inspection and manufacturing demonstrations as well as destructive analysis.

**Product Facts for Combustion and Turbine Hardware**

<table>
<thead>
<tr>
<th>Operation in accordance with GER-3620</th>
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<tbody>
<tr>
<td>Maximum firing temperature</td>
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<tr>
<td>Fuel</td>
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<tr>
<td>Operation mode</td>
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24,000 hours/900 starts
24,000 hours/1,800 starts
24,000 hours/2,700 starts

Technical review
Subject to PWPS standard terms and conditions.

**Product Facts for Compressor Hardware**

<table>
<thead>
<tr>
<th>Operation in accordance with GER-3620</th>
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<tr>
<td>144,000 hours/5,000 Starts</td>
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Design Life
Installation Hardware included
Frame 7FA.03
1st, 2nd, 3rd Stage Buckets

7FA.03 1st Stage Bucket Design Advantages:
• Trailing edge undercut to alleviate trailing edge cooling hole cracking
• Cooled platform to resolve platform burn and cracking (leading cause of scrapping 1st stage buckets)
• Improved cooling distribution to reduce peak metal temperature
• Proprietary directionally solidified alloy and PWPS2001 thermal barrier coating (TBC) system to provide improved creep and oxidation life

7FA.03 2nd Stage Bucket Design Advantages:
• Significant creep life improvement for the tip shroud
• Cutter tooth is replaced with an abrasive rail coating
• Proprietary equiaxed alloy and PWPS2001 TBC system to provide improved creep and oxidation life
• Improved fillet design to reduce stress

7FA.03 3rd Stage Bucket Design Advantages:
• Significant creep life improvement for the tip shroud
• Cutter tooth is replaced with an abrasive rail coating
• Proprietary equiaxed alloy and a chromide coating system provide improved creep and corrosion life
Frame 7FA.03
Nozzles and Shrouds

7FA.03 1st Stage Nozzle Design Advantages:
- Full gas path TBC to improve oxidation life, reduce airfoil metal temperature, and reduce thermal gradients
- Improved airfoil to sidewall fillets to improve cracking resistance

7FA.03 2nd Stage Nozzle Design Advantages:
- Full gas path TBC provides reduced airfoil metal temperature and eliminates fatigue debit from external aluminum coating
- Improved airfoil to sidewall fillets to improve cracking resistance
- Proprietary alloy improves creep, oxidation life, and maintains ability to weld repair
- Inner diaphragm material changed to 310SS for improved oxidation over Ni-Resist; more operator friendly during repair weld schemes

7FA.03 3rd Stage Nozzle Design Advantages:
- Inner diaphragm material changed to 310SS for improved oxidation over Ni-Resist; more operator friendly during repair weld schemes

7FA.03 1st Stage Shroud Block Advantages:
- Made of commercially-available 310 stainless steel alloy
- Shroud block shoes are manufactured from a proprietary nickel alloy
- Shroud tiles are coated with a proprietary coating specially formulated to provide durability with abradability for improved tip clearance control with the 1st stage bucket

7FA.03 2nd Stage Shroud Block Advantages:
- Made of commercially-available Haynes 120 (AMS 5916)

7FA.03 3rd Stage Shroud Block Advantages:
- Made of commercially-available 310 stainless steel alloy

Frame 7FA.03
Combustion Parts

7FA.03 Transition Pieces Design Advantages:
- Improved impingement cooling air and hardface coatings
- Proprietary gas path TBC for demonstrated improvement in oxidation life

7FA.03 Combustion Flow Sleeve Design Advantages:
- 304 stainless steel alloy that eliminates corrosion and pitting associated with carbon steel parts and improves oxidation life

7FA.03 Liner Cap Assembly Pieces Design Advantages:
- TBC coated effusion plate to improve component life

7FA.03 Combustion Liner Pieces Design Advantages:
- Proprietary gas path TBC for demonstrated improvement in oxidation life
- Proprietary exterior coating system for improved oxidation life
Frame 7FA.03
Compressor Hardware

R0 Compressor Blade
The PWPS R0 blade has been redesigned to address ongoing field issues with this component. The PWPS design is made from a higher strength alloy with superior corrosion and cavitation erosion resistance. Design enhancements include: dovetail relief cut, compound fillet radii transitions, and airfoil tuning to provide superior blade design life.

S0 - S4 Compressor Vane Assemblies
The PWPS S0 – S4 compressor stator vanes have been redesigned to address ongoing field issues. Design enhancements include: the fabrication of the shorter vane carrier in a non-corrosive alloy, relief slot in the vane carriers for ease of removal, elimination of shims, curved squealer tips to decrease leakage and non-uniform S0 and S1 vane spacing to mitigate R0 and R1 vibratory response.

S5 - S17, Exit Guide Vanes (EGV) Stator Vanes
The PWPS designs for all compressor vanes have arched (radius) bases to conform to the compressor case. This radius base configuration provides less wear on the components. PWPS increased the widths of the vane platforms at the horizontal joint. These vane platforms will be machined during the outage to fit the case, negating the need for shims.